Principles of Economics I
Aalto University School of Business
Juuso Välimäki

Problem Set 1 (Due Sep 15, 2023)

1. This exercise is designed to let you see what the feasible set can look like in concrete choice situations. The context is that of allocating a monetary budget of w euros between gigabytes of data per month of data transfer on a smartphone (x-axis) and all other consumption (on y-axis).

   (a) The simplest pricing scheme allows you to buy any number x of GB per month at a fixed price of p euros per GB (prices and GB are in monthly terms). How many GB can you buy if you use your entire budget on GB? Of course, you may choose not to buy any GB at all and in this case, you can use w on other consumption. Draw the set of feasible choices of (x, y), i.e. combinations of x GB of data transfer and y euros of other consumption such that you do not exceed your total budget for the case where $w = 15$ and $p = 5$.

   (b) To see the effect of a price change, draw the feasible set when $w = 15$ and $p = 3$. To see the effect of a wealth change, draw the feasible set for $w = 5$ and $p = 5$.

   (c) Consider another plan that allows you to buy up to $\overline{x}$ GB of data at a lower price $p' < p$ if you pay a fixed (monthly) payment of f euros. Any amount data above $\overline{x}$ is still sold at $p = 4$. Draw the feasible set for this plan for $w = 15$, $f = 5$, $\overline{x} = 4$ and $p' = 2$.

   (d) Often you are given the choice between alternative plans. What is the feasible set if you can choose between the plans in part a) and c)? (Hint: for each level x of data transfer, which plan delivers x at the least cost?)

   (e) In Finland, it is common to offer schemes with only a fixed payment: you can choose any x that you want without any extra charge if you pay a higher fixed fee $f^* > f$. Draw the feasible

set of this plan for $f^* = 12$ and draw the feasible set when you can choose between all three alternatives.

2. In order to move towards choice from such feasible sets, we start by forming the indifference curves of a consumer in this market.

   (a) In the (x, y) -coordinate system of the previous question, think about the shape that indifference curves should take. In particular, do you think that MRS between GB and other consumption becomes lower as you increase the number of GB's? If so, draw indifference curves reflecting this.

   (b) Suppose that because of time constraints, you will never use more than 30GB per month. What is your MRS at any point (x, y) with $x > 30$?

   (c) For the feasible set of Problem 1.a), determine graphically the optimal choice for the consumer with the indifference curves from part a) of this question. How can you express the MRT in this problem?

   (d) Consider plans from parts a) and c) of the previous question. Is it possible that a consumer is indifferent between the two plans?

   (e) We say that Ann likes data more than Bob if the MRS of Ann (denoted by MRS_A) is higher than the MRS of Bob (MRS_B) at all (x, y). Show by drawing the picture for the plan in 2.a) that at optimum, Ann chooses a higher x than Bob. (Hint: draw the picture for Ann's optimal choice and consider Bob's indifference curve through Ann's optimal consumption).

   (f) Can you think of a reason why a mobile carrier might want to introduce multiple plans instead of a single one?

3. In most economic situation, you have more than two goods to choose between. Let's start with a concrete example, where the vector (x, y, z) denotes your consumption of apples, bananas and oranges. Denote the marginal rate of substitution between apples and bananas by $MRS_{a,b}$ and similarly for apples and oranges, $MRS_{a,o}$ and bananas and oranges $MRS_{b,o}$. In words, $MRS_{a,o}$ measures the smallest number of (small units of) oranges that you would need to get in order to agree to give

up an apple (small unit of apple). Similarly, we can define $MRS_{o,a}$ as the number of apples that you need to get to agree to give up one orange.

(a) If $MRS_{a,o} = 4$ when measured at consumption (10,6,4), how large is $MRS_{o,a}$ at (10,6,4)?

(b) If $MRS_{a,o} = 4$ when measured at consumption (10,6,4), and $MRS_{o,b} = 1/3$ at (10,6,4), how large is $MRS_{a,b}$ at (10,6,4)?

(c) If you have apples, oranges, bananas and pears, and you know the marginal rate of substitution between apples and all other fruit, can you determine the marginal rate of substitution between pears and bananas?

4. An economic agent allocates her budget between food (F) and shelter (S).

(a) Draw the budget sets for the agent when the price of shelter is $p_S = 2$, the price of food is $p_F = 4$ and the agent has total income $I = 24$ at her disposal.

(b) Draw the budget set when $p_S = 4, p_F = 8$ and $I = 48$ and compare to part a. What do you conclude?

(c) Draw next the budget set when $p_S = 4, p_F = 2$, and $I = 24$ in the same picture with part a.

(d) Draw valid indifference curves for an agent so that she would choose optimally $F = 5, S = 2$ in part a?

(e) What can you conclude about the optimal choice of the agent with indifference curves as in part d. if she has the budget set of part c?